

Case Study 01:

Budweiser

Group 6

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Agenda

Market Analysis

Part I: Budweiser Dataset

Part II: Exploratory Data

Analysis

Part III: Conclusion

Questions & Comments





BEER, WINE & SPIRITS

State of hoppiness: How many IBUs in your IPA?

PUBLISHED THU, JUL 3 2014 6:00 PM EDT | BY HARRIE TAYLOR

- **Home brewing has grown in popularity (2014)**
- **Craft beer sales grew 17 %**
- **Overall beer sales down nearly 2 %**

High IBU levels have become very popular as home brewing has grown from the garage to a thriving commercial industry. Last year, the Brewers Association said overall beer sales fell nearly 2 percent, [while craft beer sales grew 17 percent](#).

Read More [Hop prices soar as US craft beer boom takes off](#)

The king of craft beers is the IPA, which requires a lot of hops. "People expect you to make an outstanding IPA," said Jeff Edgerton, the brew master for Bridgeport Brewing Co., the oldest brewery in Oregon.

There are concerns that as some IPAs have topped 100 IBUs, [they're too hoppy for human taste buds to know the difference](#). "Hops are a quick way for beginning brewers to disguise flaws in their beer," warned beer writer Adrienne So in *Slate* last year.

Even here in the heart of hops country, some acknowledge that less-gifted brewers could damage craft beer's reputation. "There's a chance we could go too far," said Edgerton, while admitting, "I love hops." However, he says it's important to balance the bitterness with flavors. "You have to be very creative."

Read More [And the best commercial beer in America is...](#)

So what does a hoppy Bridgeport beer taste like? In the video clip, Edgerton lets one reporter have a sip, and explains why a beer with 75 IBUs doesn't have to leave you feeling bitter.

—By CNBC's Jane Wells



Jeff Edgerton, Brew Master for Bridgeport Brewing says the people that sell hops, they're driving the bus right now.
Harrie Taylor | CNBC

BUDWEISER

American Style Premium Lager

Golden colored, light, crisp and clean, with subtle aroma notes of malt and noble hops, with soft fruity and citrus hop flavors and a clean, soft balanced finish

Brief History

- Known as "The King of Beers," Budweiser was first introduced by Adolphus Busch in 1876
- Brewed with the best barley malt and a blend of premium hop varieties, it is an icon of core American values like optimism and celebration
- "Budweiser became one of the first beers to take advantage of pasteurization and refrigerated rail cars. This dramatically boosted its shelf life and transportability
- "Born On" date tells you exactly when your Budweiser was brewed

Stats

ABV % – 5.0%

IBU – 12

CAL – 145

CARB – 10.6 Grams

Counties

Philadelphia
Chester
Montgomery
Bucks
Berks
Delaware
Lehigh
Northampton



VISIT SITE

Supplier:



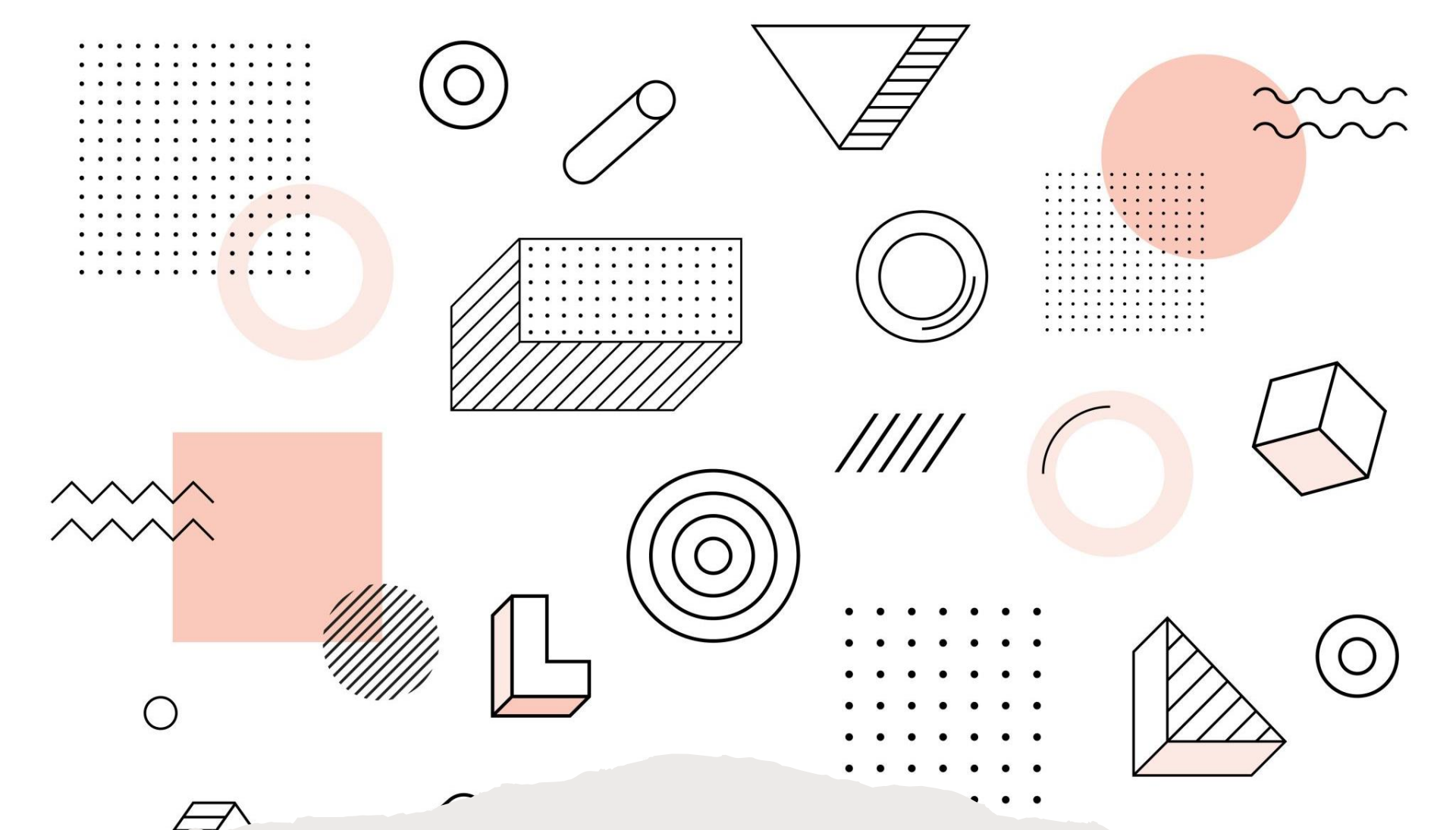
Stats

ABV % – 5.0%

IBU – 12

CAL – 145

CARB – 10.6 Grams



BREWERIES IN THE UNITED STATES

Part I: Breweries Dataset

Missing # in the Data Set



Figure 1-1. Missing variables from Beers.csv dataset



Figure 1-2. Missing variables from Breweries.csv dataset

42	SD	0.069	-Inf	0.0600	NA
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Figure 1-3. South Dakota missing IBU values in Beers.csv dataset

Beers

Missing # Value (%)

ABV 62 NA (2.6)

IBU 1005 NA (41.7)

Breweries

Missing # Value (%)

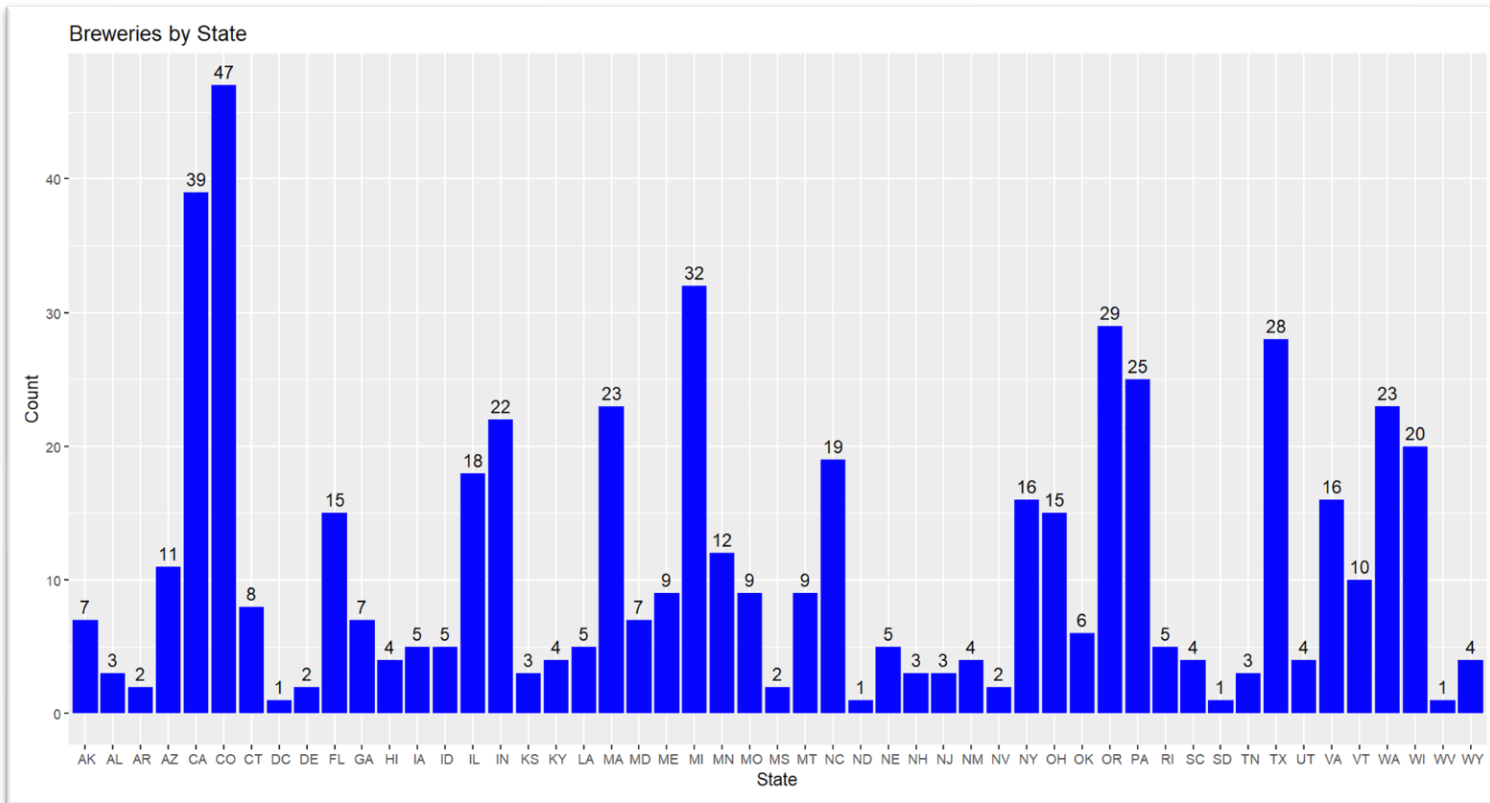
None

States

Missing # Value (%)

South Dakota -Inf NA (100)

Breweries in the US



Top 3 Distributors

- 1) Colorado
- 2) California
- 3) Michigan

Bottom 3 Distributors

- 1) West Virginia
- 2) S. Dakota
- 3) N. Dakota

Market Segmentation

West Coast
East Coast
Mid-West
South

Figure A. Frequency plot of the total number of breweries in each State in the US.

1	CO	47
2	CA	39
3	MI	32
4	OR	29
5	TX	28
6	PA	25
7	MA	23
8	WA	23
9	IN	22
10	WI	20
11	NC	19
12	IL	18
13	NY	16
14	VA	16
15	FL	15
16	OH	15
17	MN	12
18	AZ	11
19	VT	10
20	ME	9
21	MO	9
22	MT	9
23	CT	8
24	AK	7
25	GA	7
26	MD	7
27	OK	6
28	IA	5
29	ID	5
30	LA	5
31	NE	5
32	RI	5
33	HI	4
34	KY	4
35	NM	4
36	SC	4
37	UT	4
38	WY	4
39	AL	3
40	KS	3
41	NH	3
42	NJ	3
43	TN	3
44	AR	2
45	DE	2
46	MS	2
47	NV	2
48	DC	1
49	ND	1
50	SD	1
51	WV	1

Table A-1. Ranking of the total number of breweries in each State in descending order (left to right).

Heat Map of Breweries by State

Number of Breweries by State, n = 558

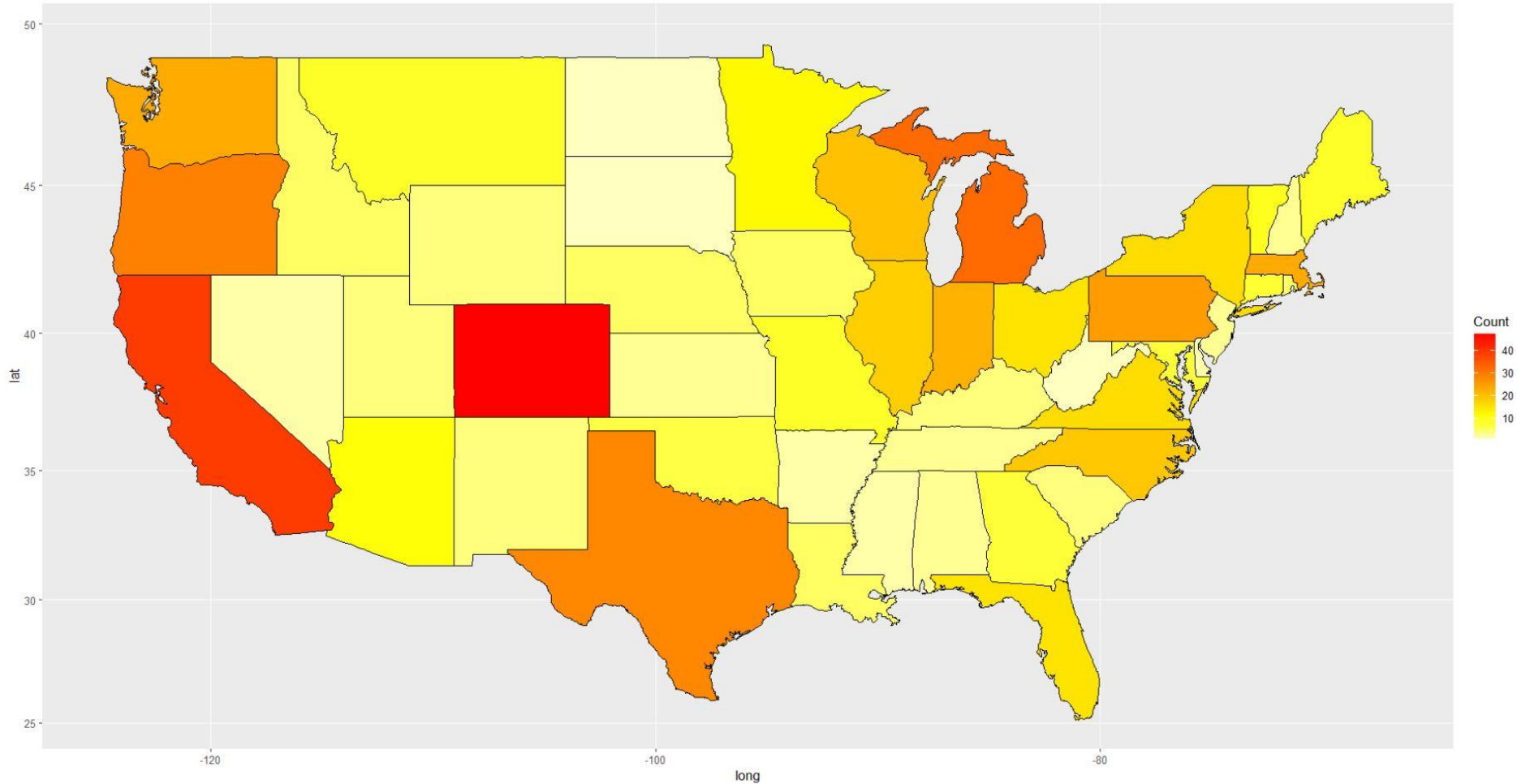


Figure B. Heat map of the US Breweries in each state.

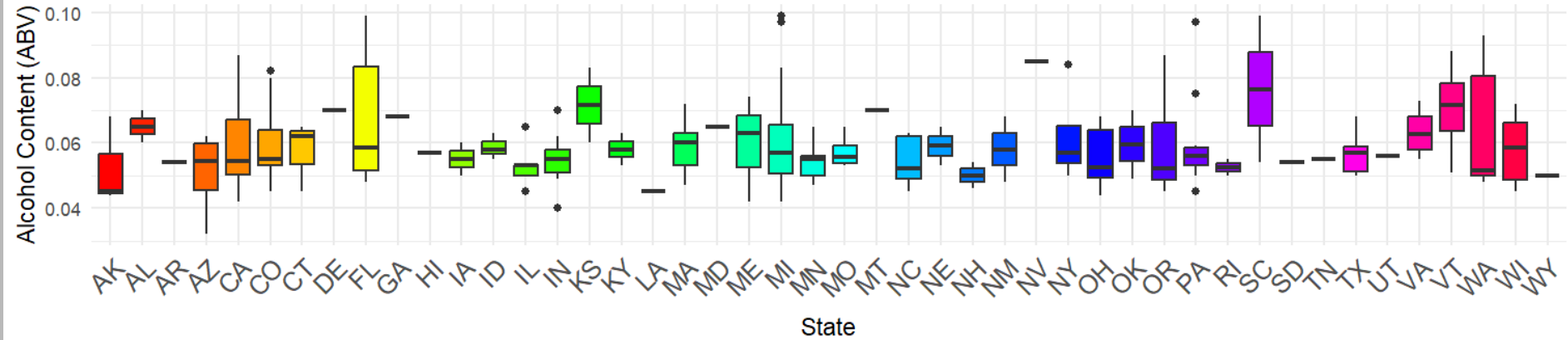


ALCOHOL BY VOLUME (% ABV) & INTERNATIONAL BITTERNESS UNITS (IBU)

Part II: Exploratory Data & Plot Analysis

Alcohol Content (ABV) and Bitterness (IBU) By State

Distribution of Alcohol Content (ABV) by State



Distribution of IBU by State

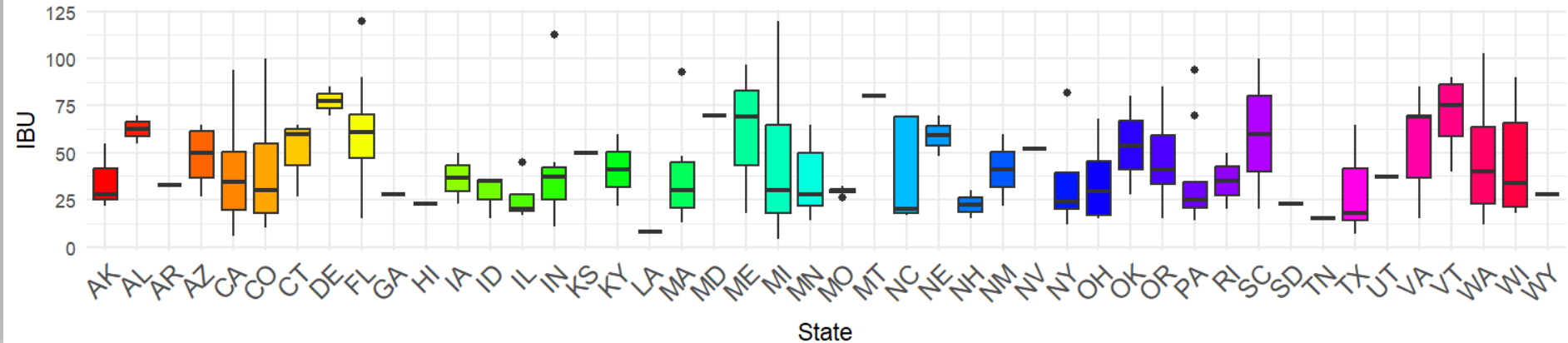


Figure A.1. Box plot of Alcohol by Volume (% ABV) (top) and International Bitterness Units (IBU) (bottom) by State

US Alcohol and IBU Heat Map

Maximum Alcohol by Vol. by State

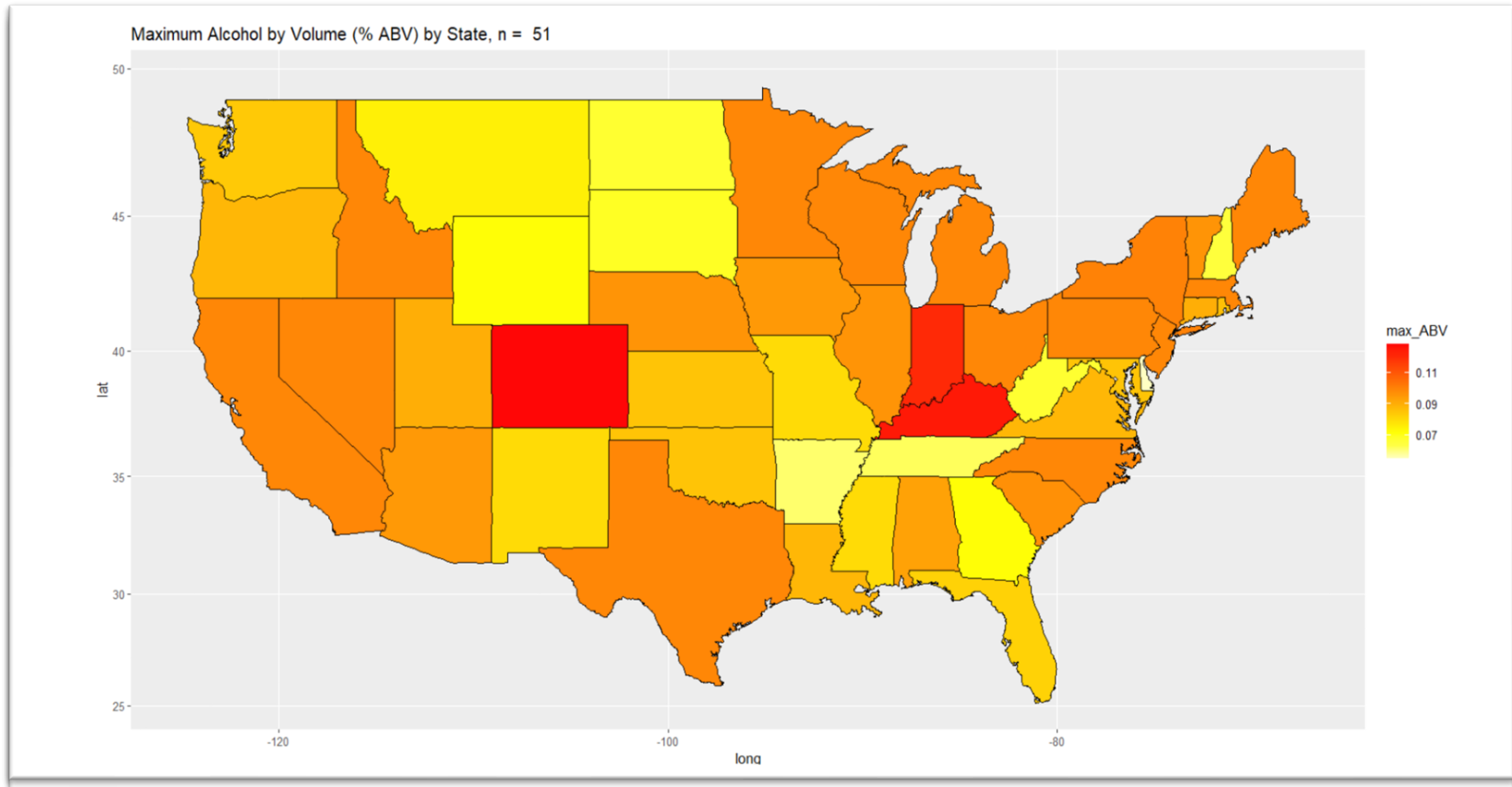


Figure B.4: Heat map of the US with Maximum Alcohol by Volume (% ABV) by State

CLASSIFICATION OF ALE & IPAS

Part III: Conclusion

Distribution of ABV and IBU by Beer Style

IPA v. Other Ale

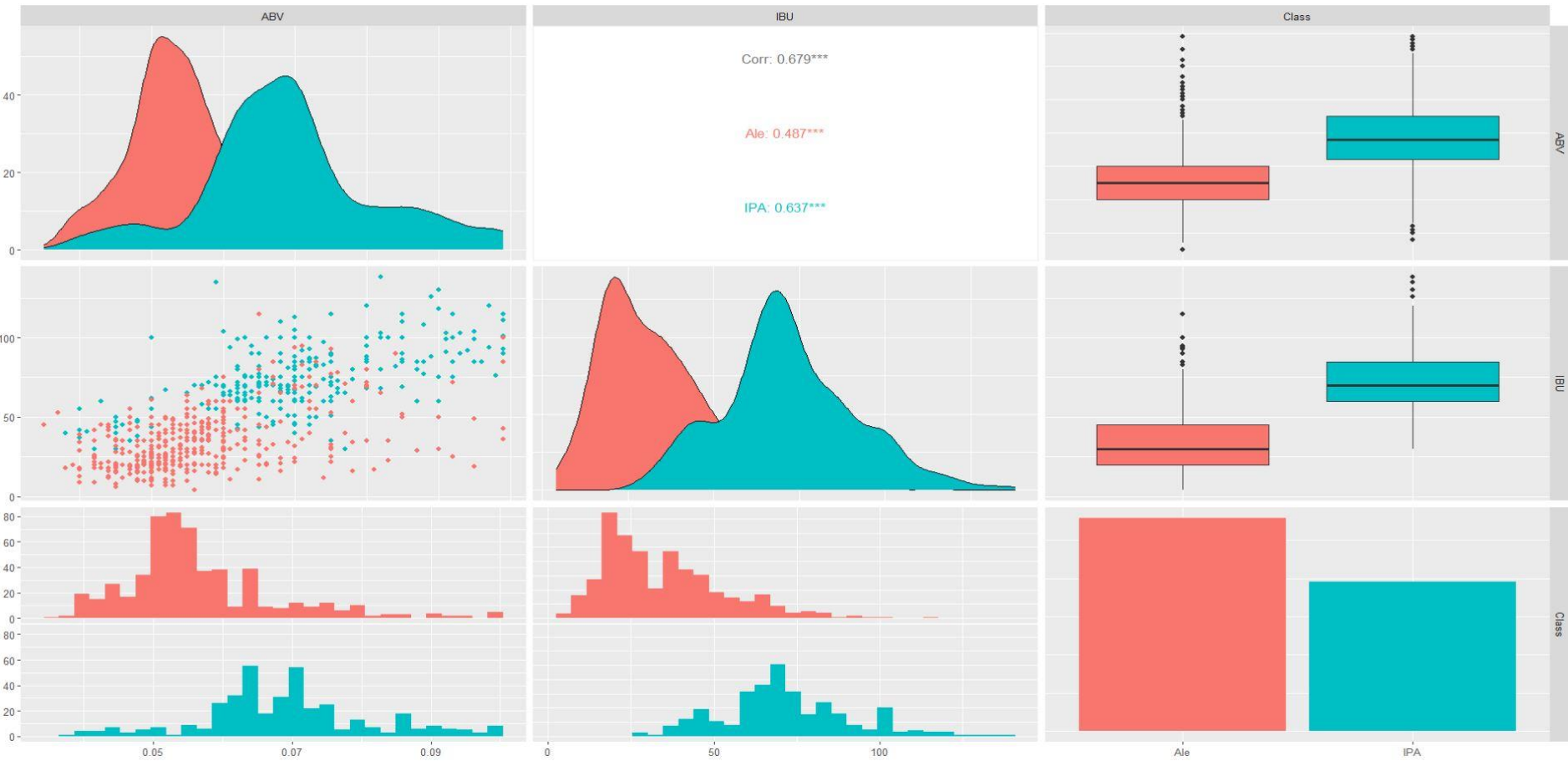


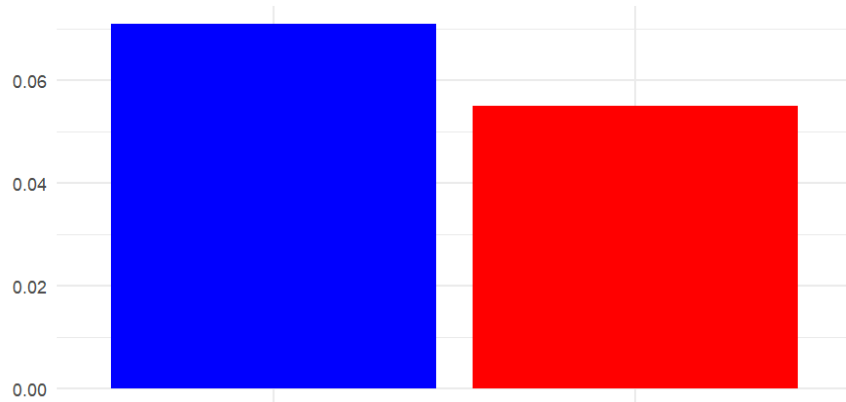
Figure D. Distribution plots of International Bitterness Units (IBU) versus Alcohol by Volume (% ABV) by Beer Style

IPA vs Other Ales

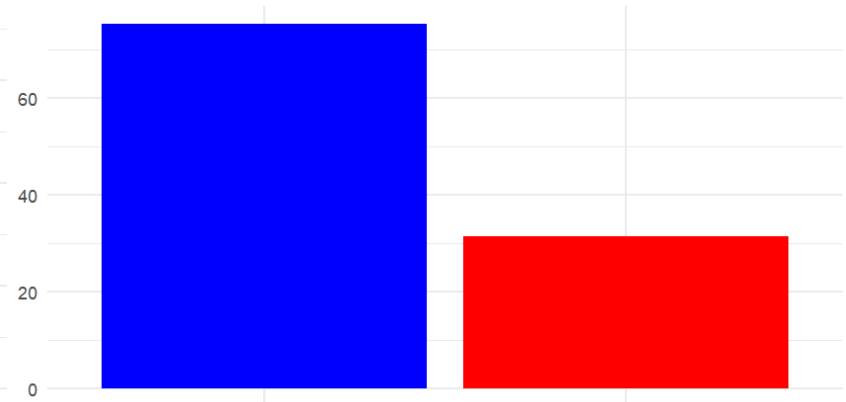
Bar plot of ABV and IBU

Summary Metrics for Beer Types

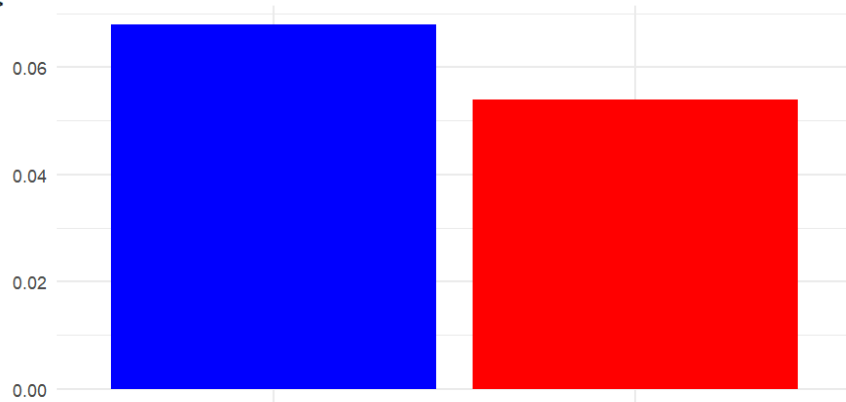
mean_ABV



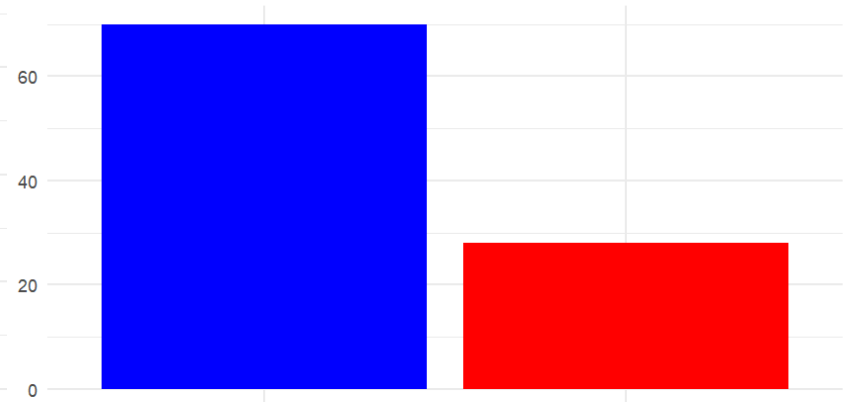
mean_IBU



median_ABV



median_IBU

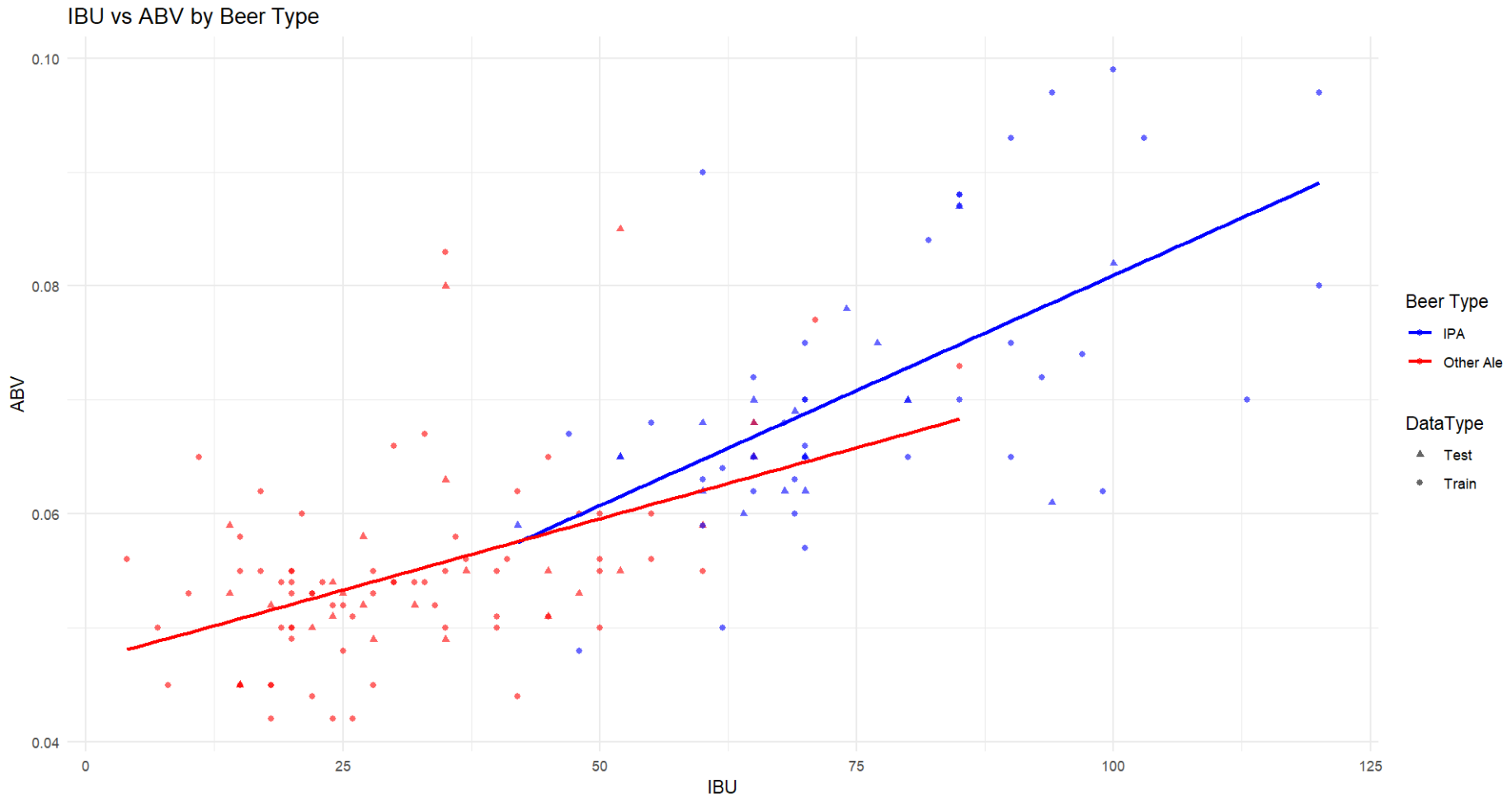


Type

IPA

Other Ale

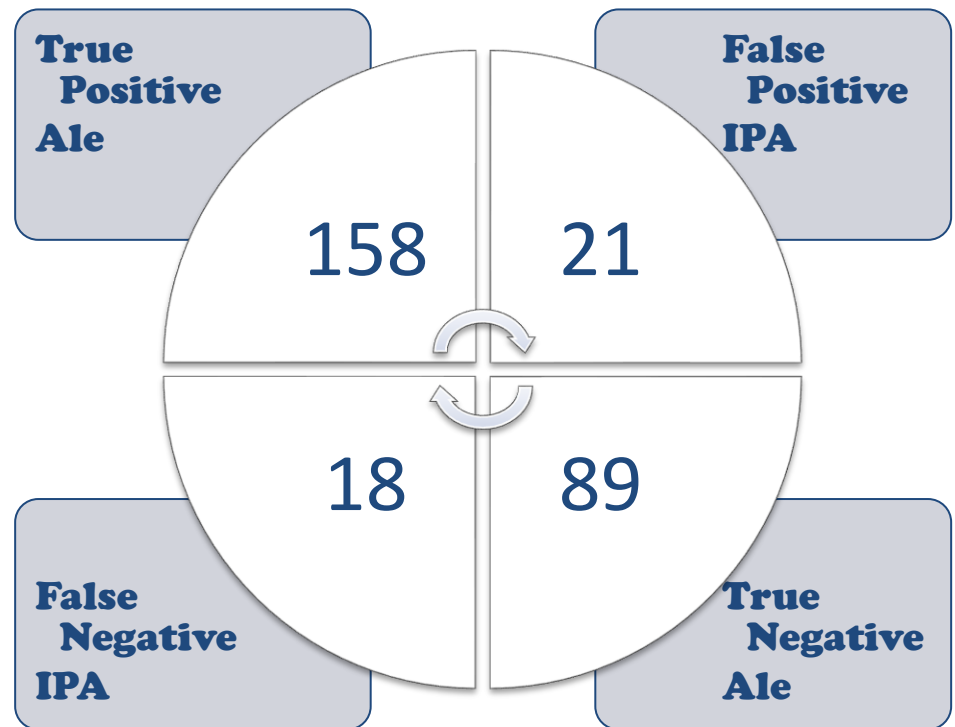
Linear Regression of ABV u. IBU by Style



k-fold Cross Validation Analysis

Confusion Matrix and Statistics:

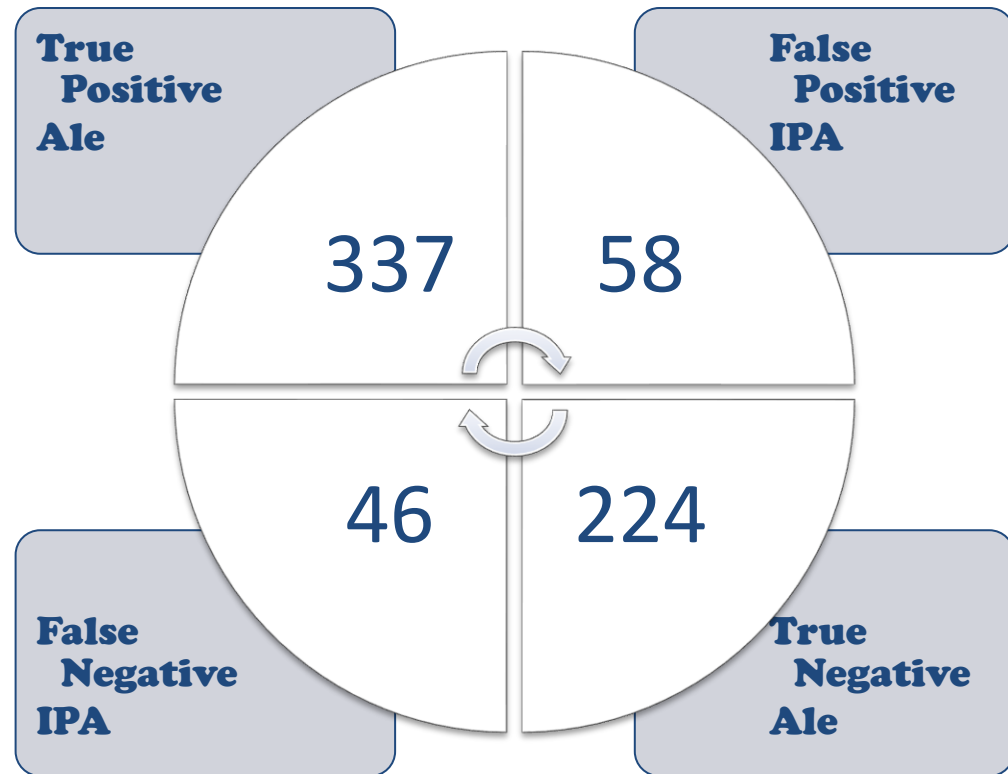
- **Positive = “Ale”**
- **Accuracy = 86.36%**
- **CI = 95%**
- **Sensitivity (Recall): 89.77%**
- **Specificity: 80.91%**
- **Precision: 88.27%**

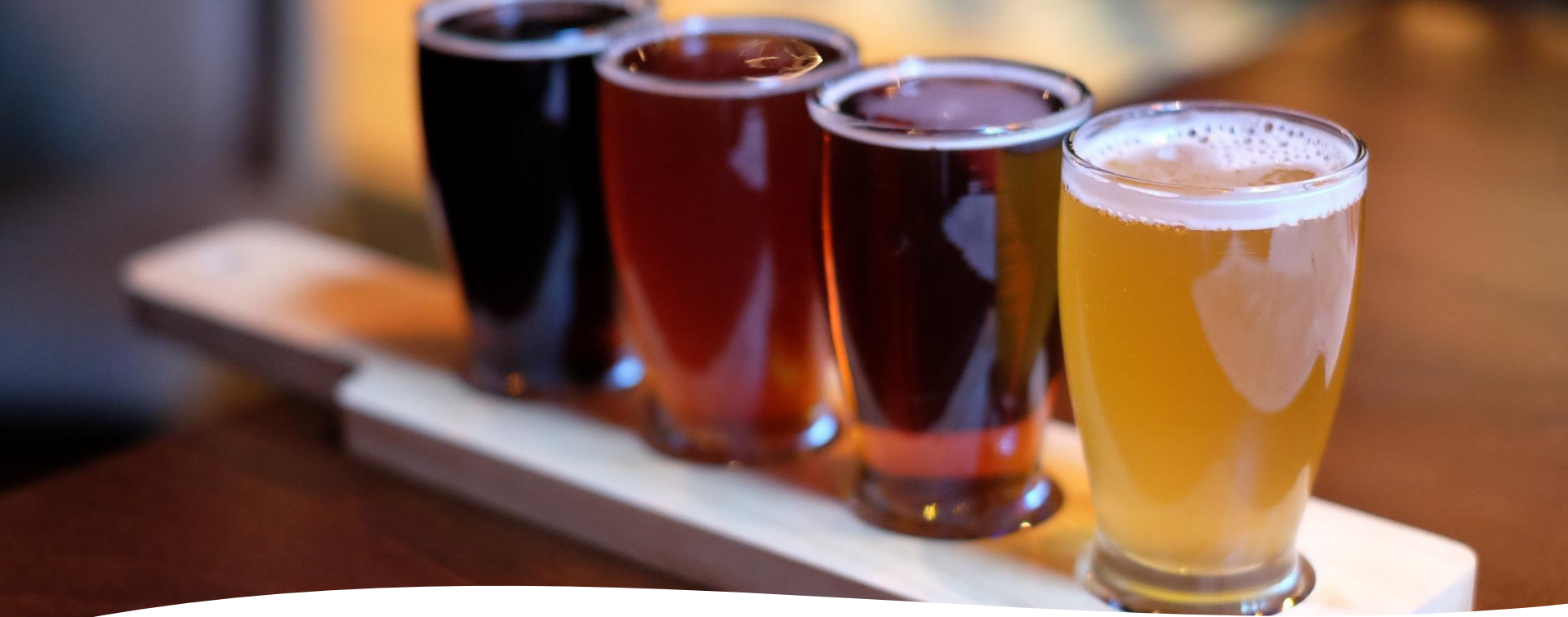


Leave One Out Cross Validation Analysis

Confusion Matrix and Statistics:

- **Positive = “Ale”**
- **Accuracy = 84.36%**
- **CI = 95%**
- **Sensitivity (Recall): 87.99%**
- **Specificity: 79.43%**
- **Precision: 85.32%**





ABV & IBU

Correlational

Analysis

Analysis between alcohol by content and bitterness:

- ☐ Beers sold are between 0.02 - .1 ABV and 5 - 80 IBU range.
- ☐ Most states prefer higher ABV between 5-6%, excluding UT and NJ
- ☐ Most states prefer less bitterness 20 - 40 IBU, excluding FL, GA, ME, WV
- ☐ There is evidence to suggest a weak positive correlation to ABV and IBU
- ☐ The more bitter the beer, the more likely it is to have a higher alcoholic content.
- ☐ Using KNN classification corresponds to our findings

The background of the slide is a vibrant blue, densely populated with numerous speech bubbles of various colors including red, yellow, pink, and light grey. Each speech bubble contains a large, bold, dark blue question mark. A large, white, rounded rectangular bubble is positioned in the center-right of the slide, serving as a container for the main text.

Questions and Comments

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APA Citation & Sources

Budweiser. (2015). Penn Beer. <https://pennbeer.com/brand/budweiser>

Wells, J. State of hoppiness: How many IBUs in your IPA?. (2014). CNBC.

<https://www.cnbc.com/2014/07/03/state-of-hopiness-how-many-ibus-in-your-ipa.html>